

PATENT

Atty. Dkt. No. APPM006716.Y1/ETCH/SILICON/MD-DAO

**AMENDMENTS TO THE CLAIMS:****RECEIVED  
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Please add claims 50-61, and amend the claims as follows:

1. (Currently Amended) A method for monitoring an etch process, comprising:
  - (a) performing pre-etch measurements of a substrate to generate pre-etch measurement information;
  - (b) applying an outlier filter to remove outliers in the pre-etch measurement information;
  - (c) analyzing the pre-etch measurement information to determine that a patterning is of a sufficient quality to allow for etching of the substrate;
  - ~~(e)~~ (d) providing the substrate along with the pre-etch measurement information to an etch reactor;
  - ~~(d)~~ (e) etching the substrate in the etch reactor using an etch process, wherein the pre-etch measurement information in combination with etch process monitoring are used to monitor an etch process endpoint; and
  - ~~(e)~~ (f) terminating the etch process based on the etch process monitoring having identified that the etch process has reached the etch process endpoint.
2. (Cancelled)
3. (Currently Amended) The method of claim 1 wherein the etch process monitoring of step ~~(e)~~ (f) further comprises achieving a pre-determined etch depth for the etch process.
4. (Currently Amended) The method of claim 1 wherein the etch process monitoring of step ~~(e)~~ (f) further comprises achieving pre-determined feature dimensions for structures formed during the etch process.
5. (Cancelled)

Page 2

510695\_1

## PATENT

Atty. Dkt. No. APPW/006716.Y1/ETCH/SILICON/MD-DAO

6. (Currently Amended) The method of claim 1 wherein the pre-etch measurement information is ~~performed~~ obtained using optical metrology.
7. (Currently Amended) The method of claim 6 wherein the optical metrology comprises one or more techniques selected from the group consisting of interferometry, scatterometry, reflectometry and ellipsometry.
8. (Original) The method of claim 1 wherein the etch process monitoring is performed using optical metrology.
9. (Original) The method of claim 8 wherein the optical metrology comprises one or more techniques selected from the group consisting of interferometry, scatterometry and reflectometry.
10. (Original) The method of claim 1 wherein the etch process monitoring further comprises:  
using a correlation between a vertical etch rate and a horizontal etch rate.
11. (Original) The method of claim 1 wherein the etch process monitoring further comprises:  
directing radiation onto the substrate;  
collecting a portion of the radiation reflected from the substrate; and  
using an interferometric measuring technique to measure a thickness of a layer.
12. (Original) The method of claim 11 wherein the radiation is directed substantially perpendicular to the substrate.
13. (Original) The method of claim 11 wherein the spectrum of the radiation directed onto the substrate comprises wavelengths in a range from about 200 to 800 nm.

## PATENT

Atty. Dkt. No. APPM/006716.Y1/ETCH/SILICON/MD-DAO

14. (Original) The method of claim 11 wherein an intensity of the radiation is modulated at a frequency of about 10 Hz.

15. (Original) The method of claim 1 wherein the etch process monitoring further comprises:

directing radiation onto the substrate;

collecting a portion of the radiation reflected from the substrate; and

measuring an intensity of wavelengths in a spectrum of the radiation reflected from the substrate.

16. (Original) The method of claim 15 wherein the etch process monitoring further comprises:

using a correlation between a spectral position of a minimum in the spectrum and a width of structures formed on the substrate.

17. (Original) The method of claim 1 wherein the pre-etch measurements are provided by one of a metrology module coupled to a process system including the etch reactor and a metrology module removed from said process system.

18. (Currently Amended) A method for monitoring an endpoint of a mask trimming process, comprising:

(a) performing pre-etch measurements of a substrate having a mask thereon to generate pre-etch measurement information of such mask;

(b) applying an outlier filter to remove outliers in the pre-etch measurement information;

(c) analyzing the pre-etch measurement information to determine that the mask is of a sufficient quality to allow for etching of the substrate;

~~(e)~~ (d) providing the substrate along with the pre-etch measurement information to an etch reactor;

## PATENT

Atty. Dkt. No. APPW006716.Y1/ETCH/SILICON/MD-DAO

~~(d)~~ (e) trimming the mask using an etch process, wherein the pre-etch measurement information in combination with etch process monitoring are used to monitor the trimming the mask a trim process; and

~~(e)~~ (f) terminating the trim process when the etch process monitoring indicates that the mask has been trimmed to pre-determined dimensions.

19. (Cancelled)

20. (Original) The method of claim 18 wherein the mask is a photoresist patterned mask.

21. (Original) The method of claim 18 wherein the mask is trimmed using a plasma process.

22. (Cancelled)

23. (Currently Amended) The method of claim 18 wherein the pre-etch measurement information is ~~performed~~ obtained using optical metrology.

24. (Original) The method of claim 23 wherein the optical metrology comprises one or more techniques selected from the group consisting of interferometry, scatterometry, reflectometry and ellipsometry.

25. (Original) The method of claim 18 wherein the etch process monitoring is performed using optical metrology.

26. (Original) The method of claim 25 wherein the optical metrology comprises one or more techniques selected from the group consisting of interferometry, scatterometry and reflectometry.

## PATENT

Atty. Dkt. No. APPM/006716.Y1/ETCH/SILICON/MD-DAO

27. (Original) The method of claim 18 wherein the etch process monitoring further comprises:
- using a correlation between a vertical etch rate and a horizontal etch rate.
28. (Original) The method of claim 18 wherein the etch process monitoring further comprises:
- directing radiation onto the substrate;
  - collecting a portion of the radiation reflected from the substrate; and
  - using an interferometric measuring technique to measure a thickness of a layer.
29. (Original) The method of claim 28 wherein the radiation is directed substantially perpendicular to the substrate.
30. (Original) The method of claim 28 wherein a spectrum of the radiation directed onto the substrate comprises wavelengths in a range from about 200 to 800 nm.
31. (Original) The method of claim 28 wherein an intensity of the radiation is modulated at a frequency of about 10 Hz.
32. (Original) The method of claim 18 wherein the etch process monitoring further comprises:
- directing radiation onto the substrate;
  - collecting a portion of the radiation reflected from the substrate; and
  - measuring an intensity of wavelengths in a spectrum of the radiation reflected from the substrate.
33. (Original) The method of claim 32 wherein the etch process monitoring further comprises:
- using a correlation between a spectral position of a minimum in the spectrum and a width of the structures formed on the substrate.

## PATENT

Atty. Dkt. No. APPM006716.Y1/ETCH/SILICON/MD-DAO

34-49. (Cancelled)

50. (New) A method for monitoring an endpoint of a mask trimming process, comprising:

(a) performing pre-etch measurements of a substrate having a mask thereon to generate pre-etch measurement information of such mask;

(b) applying an outlier filter to remove outliers in the pre-etch measurement information;

(c) providing the substrate along with the pre-etch measurement information to an etch reactor;

(d) trimming the mask using an etch process, wherein the pre-etch measurement information in combination with etch process monitoring are used to monitor trim process, wherein the etch process monitoring comprises directing radiation onto the substrate, collecting a portion of the radiation reflected from the substrate, measuring an intensity of wavelengths in a spectrum of the radiation reflected from the substrate, and using a correlation between a spectral position of a minimum in the spectrum and a width of the structures formed on the substrate; and

(e) terminating the trim process when the etch process monitoring indicates that the mask has been trimmed to pre-determined dimensions.

51. (New) The method of claim 50 wherein the mask is a photoresist patterned mask.

52. (New) The method of claim 50 wherein the mask is trimmed using a plasma process.

54. (New) The method of claim 50 wherein the pre-etch measurement information is obtained using optical metrology.

## PATENT

Atty. Dkt. No. APPM/006716.Y1/ETCH/SILICON/MD-DAO

55. (New) The method of claim 54 wherein the optical metrology comprises one or more techniques selected from the group consisting of interferometry, scatterometry, reflectometry and ellipsometry.

56. (New) The method of claim 50 wherein the etch process monitoring is performed using optical metrology.

57. (New) The method of claim 56 wherein the optical metrology comprises one or more techniques selected from the group consisting of interferometry, scatterometry and reflectometry.

58. (New) The method of claim 50 wherein the etch process monitoring further comprises:

using a correlation between a vertical etch rate and a horizontal etch rate.

59. (New) The method of claim 50 wherein the radiation is directed substantially perpendicular to the substrate.

60. (New) The method of claim 50 wherein a spectrum of the radiation directed onto the substrate comprises wavelengths in a range from about 200 to 800 nm.

61. (New) The method of claim 50 wherein an intensity of the radiation is modulated at a frequency of about 10 Hz.